



November 2012

Document M153

## ROI CASE STUDY IBM SPSS CITY OF LANCASTER

### THE BOTTOM LINE

The City of Lancaster, California needed to gain greater visibility into where Part I crimes were occurring and where they were expected to occur in the near future. By using IBM SPSS to develop predictive models for crime prevention, the City of Lancaster saw a crime rate reduction of over 35 percent compared to its benchmark crime rate measured in 2007.

ROI: **1301%**

Payback: **1.5 months**

Average annual benefit: **\$1,344,338**

### THE ORGANIZATION

---

The City of Lancaster was incorporated in 1977 to provide citizens with a greater voice in local governmental services and policies and currently has a population of over 150,000. Lancaster's police coverage is provided through a contract with the Los Angeles County Sheriff's department, which provides a fixed number of personnel for crime coverage.

### THE CHALLENGE

---

The City of Lancaster sought to solve the contradictory problem of doing more with less. Like most municipal governments, Lancaster had to deal with severe budget cuts as the Great Recession took place, which led to difficult decisions associated with police contracts and related administrative staff used to track crime. At the same time, Lancaster still had the responsibility of maintaining a safe environment for its population.

**Cost : Benefit  
Ratio | 1 : 45.5**

As one of 41 contracted cities under the Los Angeles County Sheriff's department, Lancaster wanted to provide guidance to ensure that deputies work as efficiently as

possible. To support law enforcement that was cost-efficient and effective, Lancaster used predictive analytics to understand crime trends and deploy resources more effectively.

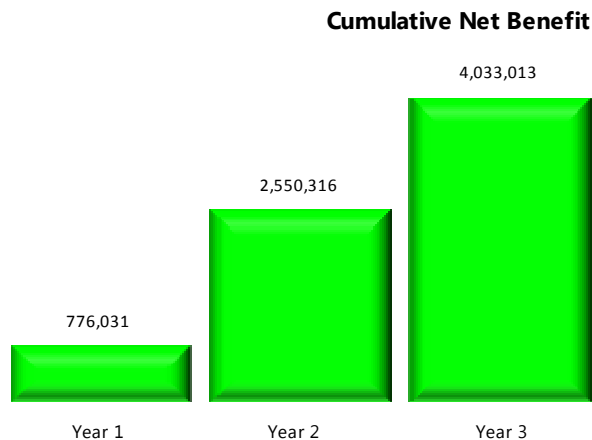
## THE STRATEGY

---

Lancaster started its predictive analytics approach to fighting crime by hiring James Kobolt as its first Senior Criminal Justice Analyst in January of 2008 to analyze data, provide recommendations, and identify new programs focused on reducing crime. Kobolt's background in both criminal justice and academia provided a combination of research and subject matter expertise to support a quantitative analysis of criminal statistics.

As Mr. Kobolt analyzed criminal and municipal data in this new role, he brought in additional tools to analyze information. Lancaster purchased IBM SPSS licenses to analyze existing data and understand trends associated with Part I crimes (defined by Uniform Crime Reporting as murder and nonnegligent homicide, forcible rape, robbery, aggravated assault, burglary, motor vehicle theft, larceny-theft, and arson). This crime data was placed in Esri's ArcGIS geographic information system to map the location of each Part I crime instance.

Initially, the City of Lancaster brought in an IBM SPSS trainer to better understand IBM SPSS Clementine (now called SPSS Modeler) and sought to build on the work that other police departments had used, but found that predictive algorithms that worked in one city weren't directly translatable to another city because crime causation variables were not as predictable as expected. Although Lancaster understood how to use IBM SPSS and possessed analytical models developed for law enforcement use, it found that additional data modeling was needed to align Lancaster's specific crime, service calls, and station bookings trends with the software.



Lancaster's data project took off when they brought in a data expert from IBM SPSS in April 2010 to model this information correctly. This data expert allowed Lancaster to

quickly translate its existing data into models that were more accurate and useful, including a time-series analysis of crime going back to January 2000. This data was inputted into Esri ArcGIS and then color-coded to create crime maps. By June of 2010, Lancaster was able to provide predictive models that maximized insight and allowed Mr. Kobolt to create heat maps of crime throughout the city.

However, Lancaster still faced challenges from the Sheriff's office. Because this was a new approach, street-wise officers were unaccustomed to using this data to guide their day-to-day activity. Mr. Kobolt found a station commander who understood data and served as an internal advocate for using the graphical map output provided to beat officers and managers. With this internal data-driven ally, Lancaster's deputies were able to enforce crime more effectively.

By hiring the correct resources, acquiring predictive and location-based analytics software, setting up the data appropriately, and getting internal buy-in, Lancaster developed a new data-driven crime prevention model that helped reduce the crime rate by over 35 percent.

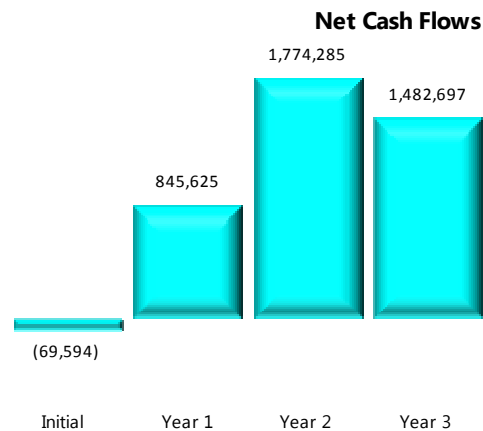
## **KEY BENEFIT AREAS**

---

The City of Lancaster sought to maximize the value received from its annual police budget of 24 million dollars. Approximately 35 percent of the department's time is spent on the direct management of Part I crimes and Nucleus estimates that predictive analytics are responsible for 50 percent of this crime reduction with the understanding that demographic changes, crime enforcement strategies, community involvement, and other trends also contributed to changes in crime.

Based on these estimates, Nucleus calculated the changes in Part I crime between the initial pre-analytics crime rate in 2007 of 449.4 crimes per 10,000 residents and the crime rate after predictive analytics were fully implemented. Lancaster saw a 35 percent reduction in 2010 and a 42 percent reduction in 2011 compared to the original 2007 benchmark rate. Although 2012 crime rates have not been finalized, Nucleus has conservatively extrapolated a Part I crime rate of approximately 290 per 10,000 residents based on a rate of 208 crimes per 10,000 as of September 30, 2012.

This additional benefit resulted in over \$800,000 value in the partial year of 2010 when predictive analytics were implemented and 1.7 million dollars in value in 2011. By using predictive and geographic analytics, Lancaster was able to gain over a million dollars in productivity on a year-over-year basis.



## KEY COST AREAS

---

The initial costs of this project included software, hardware, training costs, and ongoing support. The majority of the startup cost consisted of the original SPSS and ArcGIS licenses purchased prior to the beginning of this project. This software was hosted on pre-existing servers, which eliminated hardware costs that would have otherwise been incurred.

In addition, Lancaster had an initial training cost associated with IBM SPSS Modeler to understand how to input and output information correctly. Afterwards, Lancaster also brought in a data scientist consultant to both clean the data and appropriately structure SPSS and ArcGIS feeds to match Lancaster's key crime drivers and trends.

After this initial setup, Lancaster's ongoing support has been minimal and primarily consists of ongoing software maintenance and assurance costs. Since ongoing reports are automated, the current support for this software takes up less than an hour per month, which allows the City of Lancaster to spend less time finding the correct information and more time to translate these maps and trends into effective beat strategies to enforce crime.

## BEST PRACTICES

---

To achieve an ROI of over 1300 percent, the City of Lancaster had to create predictive models that accurately reflected its specific demographics, seasonal trends, and localized challenges. Each city has its own culture that needs to be reflected in the data modeling trends used for a predictive crime analysis.

In addition, the City of Lancaster had to make a commitment towards data analysis and a data-driven approach to augment the experience of law enforcement. By providing actionable heat maps that translated data into information that could be easily used,

Lancaster was able to provide directional insight to both where crimes previously occurred and where they were expected to happen in the future.

*With these maps, the station commander can say, "Here's where we expect crime to be. Now, I want you to prove me wrong!"*

James Kobolt, Senior Criminal Justice Analyst, City of Lancaster

## **CALCULATING THE ROI**

---

Nucleus calculated the initial and ongoing costs of software, hardware, personnel, training, and consulting over a three-year period to quantify the City of Lancaster's total investment in building and using a predictive analytics model for crime prevention.

2012 crime prevention benefits in this case study were conservatively extrapolated from a September 30, 2012 Part I crime rate that was extrapolated to a full year based on Lancaster's crime rates in 2010 and 2011.

## FINANCIAL ANALYSIS

### IBM SPSS - City of Lancaster

Annual ROI: 1301%

Payback period: 0.1 years

<b>ANNUAL BENEFITS</b>	<b>Pre-start</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Direct	0	0	0	0
Indirect	0	852,648	1,781,308	1,489,720
<b>Total per period</b>	0	852,648	1,781,308	1,489,720

<b>CAPITALIZED ASSETS</b>	<b>Pre-start</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Software	44,120	0	0	0
Hardware	0	0	0	0
Project consulting and personnel	0	0	0	0
<b>Total per period</b>	44,120	0	0	0

<b>DEPRECIATION SCHEDULE</b>	<b>Pre-start</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Software	0	8,824	8,824	8,824
Hardware	0	0	0	0
Project consulting and personnel	0	0	0	0
<b>Total per period</b>	0	8,824	8,824	8,824

<b>EXPENSED COSTS</b>	<b>Pre-start</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Software	1,518	6,273	6,273	6,273
Hardware	0	0	0	0
Consulting	9,672	0	0	0
Personnel	0	750	750	750
Training	14,284	0	0	0
Other	0	0	0	0
<b>Total per period</b>	25,474	7,023	7,023	7,023

<b>FINANCIAL ANALYSIS</b>	<b>Results</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Net cash flow before taxes	(69,594)	845,625	1,774,285	1,482,697
Net cash flow after taxes	(58,131)	469,065	979,828	819,454
<b>Annual ROI - direct and indirect benefits</b>				<b>1301%</b>
Annual ROI - direct benefits only				0%
Net Present Value (NPV)				1,904,985
<b>Payback period</b>				<b>0.1 years</b>
Average Annual Cost of Ownership				30,221
3-Year IRR				891%

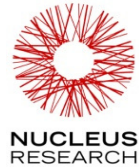
### FINANCIAL ASSUMPTIONS

All government taxes	45%
Cost of capital	7.0%



# By the Numbers

City of Lancaster's deployment of IBM SPSS



---

Annual Return  
on Investment

**1301%**

**1.5**

Months

The total time to value, or  
payback period, for the IBM SPSS  
project.

---

Cost : Benefit  
Ratio

**1 : 45.5**

**\$ 1,344,338**

Average annual benefit

## THE PROJECT

The City of Lancaster, California needed to gain greater visibility into where Part I crimes were occurring and where they were expected to occur in the near future. By using IBM SPSS to develop predictive models for crime prevention, the City of Lancaster saw a crime rate reduction of over 35 percent compared to its 2007 benchmark crime rate.

## THE RESULTS

Reduced Part I crime rate by over 35%  
No increase to City of Lancaster police budget

---

Number of **users: 100**

**2**

Months

Total time for City of Lancaster to  
deploy IBM SPSS

---

"With these maps, the station commander can say, 'Here's where we expect crime to be. Now, I want you to prove me wrong!'"

- James Kobolt, Senior Criminal Justice Analyst, City of Lancaster